



Institute of Botany
Faculty of Life Sciences
University of the Punjab, Lahore
Course Outline
Semester – VI



Programme	BS	Course Code	BOT-317	Credit Hours	3
Course Title	Molecular Genetics (Theory)				
Introduction					
This course includes concepts regarding Recombinant DNA and its applications, gene expression, mechanisms of genetic changes including mutation, recombination, transposable elements and genome projects.					
Learning Outcomes					
On completion of the course, the students will be:					
<ul style="list-style-type: none"> • able the students to understand the structural and functional basis of genes and gene expression, DNA and genetic changes including mutation, recombination and transposable elements. • able the students to understand various DNA manipulations at the molecular level. Students are expected to get themselves familiarized with the molecular/macromolecular organization of genetic material. • able to understand the possibilities of structural organization and molecular backbones regarding DNA. • able to understand the basic concepts with reference to DNA amplification and other molecular techniques. 					
Course Contents					
<ul style="list-style-type: none"> • Recombinant DNA: Recombinant DNA Technology – Introduction, Basic Techniques, PCR. Restriction enzymes, DNA sequencing, plasmids and bacteriophages as a tool for genetic manipulation. The formation of recombinant DNA, Restriction and modification system, recombinant DNA and social responsibility • Principles of Recombinant DNA technology: Role of Recombinant DNA Technology in economic development. Site directed mutagenesis. • Application of Recombinant DNA technology using prokaryotes in plants and animals; Recombinant DNA technology in eukaryotes - An overview, transgenic yeast, transgenic plants, Transgenic animals. • Gene therapy, Genetically modified organisms and apprehensions • Control of Gene Expression: Discovery of the <i>lac</i> system: Negative control system. Lac Operon. Catabolite repression of the <i>lac</i> operon: Positive control. Transcription: Gene regulation in eukaryotes - An overview. • RNA Processing: Exons & introns, splicing, Self-splicing introns, RNA editing, Trans-splicing, RNA interference, siRNAs, miRNAs, ncRNAs. • Genetic Change-Gene Mutation: The molecular basis of gene mutations, spontaneous mutations. Induced mutations, Mutagens and carcinogens. Biological repair mechanisms. • Genetic Change-Recombination: General homologous recombination, the holiday model, Enzymatic mechanism of recombination. Site-specific recombination, recombination regarding chromosomal rearrangements. • Genetic Change - Transposable Genetic Elements: Insertion sequences, transposons. Transposable elements in prokaryotes, Controlling elements in maize. • Molecular markers: Introduction, Dominant, Co-dominant markers system, RFLP, AFLP, SNPs. • Introduction to Human and Plant Genome Project. • CRISPR-Cas – An Advance technology for Gene Editing. • Bioinformatics - Applications in genetics and genome analysis. • Bioethics: Moral, Religious and ethical concerns 					

Programme	BS Botany	Course Code	Bot-318	Credit Hours	1
Course Title	Molecular Genetics (Lab)				
Lab Course Contents					
<ul style="list-style-type: none"> • Problems related to the theory, Isolation and separation of DNA and protein on Gel electrophoresis. • Quantitative separation of macromolecules (Plasmid DNA, plant DNA, Protein) using electrophoresis. • DNA Amplification by PCR 					
Textbooks and Reading Material					
<ol style="list-style-type: none"> 1. Gelvin S. B. (2000) <i>Plant Molecular Biology Manual</i>. Kluwer Academic Publishers. 2. Primrose S. B., Twyman R. M., and Old R. W. (2004) <i>Principles of Gene Manipulation</i>, an Introduction to Genetic Engineering, Blackwell Scientific Publications. 3. Dronamraju, K. (2019). <i>A Century of Geneticists: Mutation to Medicine</i>. CRC Press. 4. Brown, T. A. (2020). <i>Gene Cloning and DNA Analysis: An Introduction</i>. John Wiley & Sons. 5. Henkin, T. M., & Peters, J. E. (2020). <i>Snyder and Champness Molecular Genetics of Bacteria</i>. John Wiley & Sons. 6. Griffiths, A. J. (2020). <i>An Introduction to Genetic Analysis</i>. Macmillan learning. 7. Latchman, D. (2015). <i>Gene Control</i>. Garland Science. 8. Grotewold, E., Chappell, J., & Kellogg, E. A. (2015). <i>Plant Genes, Genomes and Genetics</i>. John Wiley & Sons. 9. Brown, T. A. (2012). <i>Introduction to Genetics: A Molecular Approach</i>. Garland Science. 10. Ignacimuthu S. (2005) <i>Basic Bioinformatics</i>, Narosa Publishing House, India. 11. Lwein B. (2004) <i>Gene VIII</i>, Pearson Education Int. 12. Snyder L. and Champnes W. (2003) <i>Molecular Genetics of Bacteria</i>, ASM Press. 13. Wilson J. and Hunt T. (2004) <i>Molecular Biology of the cell – the problems book</i>, Garland publishing Inc. 					
Teaching Learning Strategies					
<ul style="list-style-type: none"> • Lectures • Group Discussion • Laboratory work • Seminar/ Workshop 					
Assignments: Types and Number with Calendar					
<ul style="list-style-type: none"> • Lecture Based Examination (Objective and Subjective) • Assignments • Class discussion • Quiz • Tests 					
